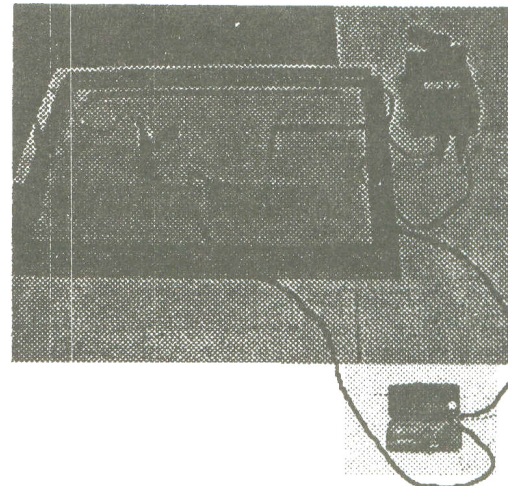


LAB - Mapping an Electric Field

PURPOSE: The purpose of this lab is to take measurements within and around an electric force field and type the data into appropriate software to produce a three dimensional map of the force field.

SETUP: Use a metal frame window as the basis for setting up the force field. Place a graph paper grid under the window and tape it onto the glass. Select two electrodes of your choice and place them in the window with one electrode at each end of the graph paper with some margin of graph paper around each one. You can choose any combination of points and/or shaped electrodes. Connect a battery or power supply to the apparatus with the negative terminal connected to the metal frame and the positive terminal connected to one of the electrodes. Use another wire to connect the remaining electrode to the metal frame, which will make this the negative terminal. Pour enough water into the bottom of the window to just cover the glass and reach up to the metal frame. This completes the setup.

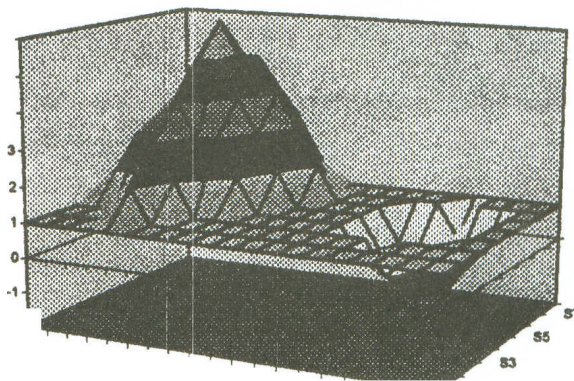


PROCEDURE: Use a small digital voltmeter and connect its negative terminal to the metal frame of the window. Use the positive terminal of the voltmeter as your probe. Starting at the A,I point of the grid, place the positive terminal of the voltmeter at each point of the entire grid. Take care to hold the probe perpendicular to the water and wait long enough for the meter to give a reasonably steady reading. Read out the voltage at each point, and have a partner type the voltage reading into an EXCEL spreadsheet point for point. The number can be typed into a particular cell, and then one of the arrow keys can be pressed to take you to the next cell, depending on which way you want to go on the spreadsheet. The designation of the EXCEL spreadsheet cell should match the coordinates of the graph paper.

ANALYSIS: When the data (all of the voltage readings) have been entered into the spreadsheet, you should now produce a three-dimensional chart.

INSTRUCTIONS TO PRODUCE A 3-D CHART OF THE ELECTRIC FIELD:

- After the data has been entered, the next step is to "select" all of the data. Then you click the mouse on the ChartWizard icon on the toolbar. You then use the mouse to outline a box over the data to contain the chart. When the box is drawn, click on NEXT.
- A window with a selection of chart types will appear (Step 2 of 5). Click on 3-D Surface Chart in the lower right corner, and click NEXT.
- The next window will give you a choice of 3-D chart types (Step 3 of 5). Accept the default by clicking NEXT.
- A preliminary chart will appear. (Step 4 of 5). Accept the default settings by clicking on NEXT. Step 5 of 5 will offer to let you have a legend. Click NO and then click FINISH. The completed chart should appear. It may look something like the picture to the right.



Double click on the center of the chart. Follow that with a single click. Little drag handles should appear at each corner of the chart. You can use any of the handles to drag and rotate the chart to any orientation you want. When you have a view you like, let go of the mouse button. Click outside of the chart to clear the drag handles. You can print a copy of the chart and then slightly rotate the chart to left or right and print out another copy. If you take these two copies of the chart to the 3-D viewer, and place them correctly, you will get to see a truly three-dimensional view!

FURTHER ANALYSIS:

Use the drag handles and move the chart so you are looking straight down on the top of the chart. This will produce what is called a contour chart. Print out a copy of this chart.

On the printed copy of the contour chart, draw electric field lines, which will be perpendicular to the contour lines. This would represent the paths that charges would take as they "fell" through the electric force field.

Turn in the 3-D charts and the contour chart. Be sure your name is on the top of each chart.